

Experience from a multicentre stroke register: a preliminary report

S. HATANO ¹, on behalf of the participants in the WHO Collaborative Study on the Control of Stroke in the Community ²

In collaboration with 15 centres in 10 countries of Africa, Asia, and Europe, WHO started a pilot study of a community-based stroke register, with standardized methods. Preliminary data were obtained on 6395 new cases of stroke in defined study communities, from May 1971 to September 1974. Information on incidence rates, clinical profiles, diagnosis, management, and course and prognosis for these patients is given.

The WHO stroke register was started in May 1971 as a joint undertaking of WHO and a number of collaborating centres, in response to a recommendation made at a WHO seminar (1, 4). It was the first attempt to collect data on stroke in the community, in a uniform manner, from countries with different social, cultural, and environmental backgrounds.

This paper gives the preliminary results, describes the characteristics of stroke in various communities, and shows the potential use of a community-based stroke register for epidemiological research and for the planning and evaluation of public health activities. The data were obtained from 6395 new cases of stroke from 15 centres in 10 countries during the period 1971-74.

METHODS

The standard nomenclature, criteria, and manner of reporting were described in detail in the operating manual,^a and only the essential points are outlined here.

A stroke was defined as rapidly developing clinical signs of focal (at times global^b) disturbance of cerebral function, lasting more than 24 h or leading to death with no apparent cause other than that of

vascular origin. Transient episodes of cerebral ischaemia were excluded by definition. Cerebrovascular lesions discovered at autopsy without having shown clinical manifestations in life were not registered as stroke.

Profiles of the 15 participating centres are given in Table 1. All the study areas were well defined geographically. Fourteen of the centres studied the general population in their areas and one studied an occupational group consisting mainly of men below the age of 55 years. No limitations of age and sex were set in the study areas, except for Gothenburg and Fukuoka. Colombo and Rohtak joined the study in 1974, but the data for these centres have not been included in the analysis on account of the small number of cases involved so far.

For a register to be of value, complete coverage of patients in the defined population is essential. A stroke register centre was established as a focal point for stroke control programmes in each study area. This centre contacted the local authorities, hospitals, and medical practitioners to ensure notification of every stroke case occurring in the community.

The same record forms were used in all the participating centres in order to ensure uniform data collection: initial record form; follow-up record form, to be used 3 weeks, 3 months, and 1 year after the onset of stroke; death record form; recurrence record form; and exclusion record form to terminate follow-up when a diagnosis other than acute stroke was established.

The choice of diagnostic methods was left to consulting physicians. The procedures used for

¹ Department of Epidemiology, Tokyo Metropolitan Institute of Gerontology, 35 Sakaecho, Itabashi-ku, Tokyo, Japan.

² Listed on page 552.

^a Unpublished WHO document CVD/S/73.6 Rev. 1, 1973.

^b The term "global" is applied to patients in deep coma and to those with subarachnoid haemorrhage.

Table 1. Experience from a multicentre stroke register: study areas and populations

Centre	Country	Characteristics of study area and population	Total population (thousands)	Population structure	
				Men/women	Percentage ≥ 65 years
Gothenburg	Sweden	Urban. Age up to 65 years at entry	450.9	0.98	13.1
Copenhagen ^a	Denmark	Mainly residential and commercial; + light industry	100.0	0.82	21.5
Dublin	Ireland	Mainly residential	133.7	0.91	8.4
Espoo ^b	Finland	Developing neighbour town to Helsinki. Commerce, services, and industry	103.5	0.93	5.0
North Karelia	Finland	Mainly agricultural. Emigration continues	178.3	1.00	8.9
Moscow ^c	USSR	Urban	data not available		
Zagreb	Yugoslavia	Urban	87.9 ^d	0.84 ^d	12.8 ^d
Zerifin ^e	Israel	Urban and rural; 50 % Afro-Asian and 50 % Euro-American origin	218.4	1.02	6.9
Epe ^f	Nigeria	Mostly agricultural. Traders, fishery & factory workers	data not available		
Akita	Japan	Rural. Agriculture and commerce	36.1	0.95	5.9
Saku	Japan	Rural. Mainly agriculture + commerce, light industry	105.2	0.92	10.5
Fukuoka	Japan	Urban. Part of Fukuoka City + 3 towns. Age below 65 years in part	36.8	0.94	7.2
Osaka	Japan	Semi-urban. Commuter area to Osaka. Services, agriculture, and commerce	40.4	0.93	4.7
Japan National Railways	Japan	Male employees of a company in the Tokyo region. Age up to 59 years	76.8	—	0
Ulan Bator	Mongolia	Urban	261.3	1.04	4.4

^a Area of study: Frederiksberg, Copenhagen.

^b Area of study: Espoo and Kuusinkangas.

^c Area of study: Tushino, Moscow.

^d Population size is known up to age 74 years.

^e Area of study: Ramle and Rehovot.

^f Area of study: Epe and Ibadan.

examining 4036 survivors during the 3 weeks following stroke are indicated here to show how a stroke was diagnosed for the register. Nearly all patients were seen by a physician and two-thirds were seen by a neurologist. Lumbar puncture was performed in two-fifths; cerebral angiography and brain scan in about one-sixth; electroencephalogram (EEG) in one-third; and electrocardiogram (ECG) in 80%. Autopsy was performed in 30% of 2951 deaths. The frequency of examinations and the autopsy rate varied greatly among centres and for different types of stroke (see pages 545-546).

RESULTS

Number of patients and incidence rates

Of the 6395 registered patients, 3270 were men and 3122 women. The age or sex of 3 was unknown. The number of patients at a centre ranged from 106 to 778 (Table 2).

Men outnumbered women in all except the highest age group (75 years and over—not shown in table). The ratio of men to women reflected the age structure of the study population: the older the population, the greater the proportion of women patients.

Table 2. Number and distribution according to age (years) and sex of stroke patients

Centre	No. of patients	Men aged		Women aged		Ratio men/women	Ratio ≥ 65 /all ages (%)
		≤ 64	≥ 65	≤ 64	≥ 65		
Gothenburg	690	388	30	249	23	1.54	7.7
Copenhagen	640	81	194	47	318	0.75	80.0
Dublin	453	88	111	65	189	0.78	66.2
Espoo	299	73	67	58	101	0.88	56.2
N. Karelia	774	204	186	142	242	1.02	55.3
Moscow	563	121	113	105	224	0.71	59.9
Zagreb	475	84	156	75	160	1.02	66.5
Zerifin	778	120	246	111	301	0.89	70.3
Epe	238	111	38	72	17	1.67	27.3
Akita	266	85	59	49	73	1.18	49.6
Saku	546	116	184	60	186	1.22	67.8
Fukuoka	108	41	30	16	21	1.92	47.2
Osaka	133	23	43	23*	44	0.99	65.4
Japan Nat. Railways	106	106	0	0	0	—	0
Ulan Bator	323	114	58	105	46	1.14	32.2
All centres	6392	1755	1515	1177	1945	1.05	54.1

Patients were much older, on the average, in Copenhagen, Saku, Zagreb, and Zerifin than in Akita and Ulan Bator. In Nigeria, they were very young. However, in three centres where there was an upper age limit for registration—Gothenburg, Fukuoka, and Japan National Railways, Tokyo—the average age of patients was lower than it might have been without such an age limit.

The incidence rate of the first attack rose steeply with age (Table 3), being about 0.1–0.5 per thousand at ages below 55 years, about 2–5 in the age group 55–64 years, 5–10 in the age group 65–74 years, and 10–20 at 75 years and over. This increase in incidence with age was not seen in Ulan Bator, probably owing to under-reporting of old patients.

Stroke occurred in both developing and developed countries, and there was little difference in the incidence according to sex. In these respects, the incidence of stroke differed from that of ischaemic heart disease.

The incidence was high in Akita, North Karelia, and Saku in both sexes and in all age groups. Equally high, or even higher, rates among the old, but lower rates in the young, were seen in Espoo and Osaka—recently developed satellite cities to Helsinki

and Osaka, respectively. The very high incidence observed in employees of the Japan National Railways aged 55 years and over was due to the small number of persons of that age group in that community.

Case reports

Recurrent strokes accounted for 10–15% of all strokes. This proportion was 30% or more in Moscow, Ulan Bator, and Zagreb—perhaps on account of the varying criteria used in the past.

The frequency of acute myocardial infarction in the past was high (10%) in all the European and in the Israeli communities included in the study, but low or non-existent in the Asian and African communities. This reflects the prevalence of ischaemic heart disease in the general population.

Since no strict criteria were established for “other heart disease”, comparable figures for this could not be obtained. Nevertheless, heart disease other than myocardial infarction was mentioned by one in three patients with stroke.

Hypertension was the condition most frequently mentioned in case histories, being reported by more than half of the stroke patients included in the study.

Table 3. Incidence rate of first attack of stroke per 1000 population per annum, according to age (years), and sex

Centre	Males					Females				
	Under 55	55-64	65-74	≥ 75	Total	Under 55	55-64	65-73	≥ 75	Total
Gothenburg ^a	0.2	2.6			0.5 ^b	0.2	1.6			0.3 ^b
Copenhagen	0.2	3.4	6.8	12.8	2.0	0.1	1.5	4.0	12.9	2.3
Dublin	0.2	3.8	7.4	16.9	1.2	0.2	2.2	5.8	18.3	1.3
Espoo	0.4	4.4	12.0	24.2	1.2	0.3	2.3	8.8	23.1	1.3
North Karelia	0.5	5.2	9.4	18.5	1.8	0.4	3.7	8.5	16.8	1.9
Moscow	No population data available									
Zagreb	0.3	3.2	5.2	NA	1.2 ^c	0.3	1.4	3.1	NA	0.8 ^c
Zerifin	0.1	3.0		9.9	1.0	0.1	2.9		11.9	1.2
Epe	No population data available									
Akita	1.1	9.3	20.0	22.1	2.9	0.5	6.6	18.7	28.7	2.3
Saku	0.6	6.4	11.7	24.7	2.5	0.2	2.7	7.6	22.0	1.8
Fukuoka	0.3	5.9	9.0	3.0	1.2	0.1	1.0	3.3	4.8	0.5
Osaka	0.1	5.4	14.9	31.9	1.2	0.1	3.8	7.8	29.5	1.1
Japan National Railways ^d	0.5	17.0			0.5					
Ulan Bator	0.1	2.3	2.7	2.6	0.3	0.1	1.2	2.1	2.9	0.3

^a The registration of stroke patients did not cover persons over 64 years of age.

^b Rate for population under 65 years of age.

^c Rate for population under 75 years of age.

^d The registration of stroke patients covered only males under the age of 65 years.

NA = not available.

Since the presence of hypertension may not be recognized by all hypertensive subjects, this figure should be considered as a low estimate. About two-thirds of the patients known to be hypertensive had received treatment of their hypertension just before their strokes occurred. This is the same as the rate reported in the general population (2, 3, 5). The proportion of patients who had been given treatment varied according to the centre, ranging from 30% in Fukuoka and Osaka to 96% in Ulan Bator.

Diagnostic criteria for diabetes mellitus were not standardized, and the prevalence of diabetes was not comparable. A high rate (30%) was reported from Zerifin, and a rate of nearly 20% from North Karelia and Zagreb. Other centres reported rates of the order of several per cent.

The victims of stroke were frequently weak people: about one-tenth of those below 65 years of age and one-quarter of those aged 65 years and over had been unable to care for themselves before their strokes occurred. In the younger age group 3% and in the older age group 12% of patients had had impaired bladder control before the onset of stroke.

Many of these patients had experienced a stroke before.

Clinical signs and symptoms

Signs and symptoms were assessed at the maximum impairment, within 24 h of their onset. Later deterioration was not taken into account.

Consciousness. Four levels of consciousness were distinguished. About half of the patients were fully conscious and about one-fifth were comatose; two-thirds were normal or only slightly disturbed (awake or somnolent) and one-third more severely (semi-comatose or comatose). Consciousness was not assessed in a few patients, who may have died before having been seen by a physician.

Speech disturbance and loss of motor control of limbs. Paralysis of the limbs was classified as mono-, hemi-, or paraplegia, or bilateral paralysis of three or four limbs. A similar classification was adopted for paresis. Complete and incomplete paralysis were not differentiated. Hemiplegia was the most frequent, appearing in 70% of patients with little variation among centres. Paralysis was not assessed in the

Table 4. Diagnosis of the type of stroke and examinations performed

Centre	ICD 430				ICD 431				ICD 432-434				All types of stroke ^a			
	No. of cases	% of stroke cases	No. examined ^b	% examined ^b	No. of cases	% of stroke cases	No. examined ^b	% examined ^b	No. of cases	% of stroke cases	No. examined ^b	% examined ^b	No. of cases	% of stroke cases	No. examined ^b	% examined ^b
Gothenburg	83	16.7	83	100.0	50	10.0	50	100.0	156	31.3	146	93.6	498	100.0	317	63.7
Copenhagen	12	2.6	12	100.0	30	6.5	20	66.7	323	69.5	100	31.0	465	100.0	165	35.5
Dublin	13	4.3	13	100.0	6	2.0	6	100.0	15	5.0	11	73.3	300	100.0	87	29.0
Espoo	28	14.7	28	100.0	14	7.4	14	100.0	133	70.0	90	67.7	190	100.0	132	69.5
North Karelia	68	12.7	63	92.6	16	3.0	12	75.0	347	64.9	96	27.7	535	100.0	204	38.1
Moscow ^c																
Zagreb	4	1.4	4	100.0	7	2.5	4	57.1	170	60.7	94	55.3	280	100.0	130	46.4
Zerifin	5	1.1	5	100.0	2	0.5	1	50.0	280	63.3	175	62.5	442	100.0	274	62.0
Epe	11	10.6	11	100.0	18	17.3	11	61.1	57	54.8	20	35.1	104	100.0	47	45.2
Akita	19	10.2	14	73.7	41	21.9	17	41.5	118	63.1	23	19.5	187	100.0	57	30.5
Saku	33	10.1	25	75.8	35	10.7	27	77.1	259	79.0	115	44.4	328	100.0	167	50.9
Fukuoka	6	10.3	6	100.0	7	12.1	1	14.3	41	70.7	19	46.3	58	100.0	27	46.6
Osaka	5	6.1	2	40.0	15	18.3	1	6.7	59	72.0	4	6.8	82	100.0	7	8.5
Japan National Railways	13	18.3	10	76.9	4	5.6	2	50.0	51	71.8	21	41.2	71	100.0	34	47.9
Ulan Bator	21	14.9	21	100.0	45	31.9	43	95.6	60	42.6	53	88.3	141	100.0	132	93.6
All centres	321	12.0	297	92.5	290	10.9	209	72.1	2069	77.6	967	77.6	3681	100.0	1780	48.4

^a Including ICD 436.^b Performance of any type of lumbar puncture, angiography, or brain autopsy.^c Data not available.

deeply comatose patients (13% of all patients), in whom accurate neurological assessment would have been difficult. Such cases were observed more often in Espoo, Fukuoka, and Japan National Railways than in the other centres. Cases in which there was neither speech disturbance nor paralysis of the limbs were considered as mild cases or cases of subarachnoid haemorrhage, particularly the latter at the acute stage. They accounted for over 10% of cases in Espoo, Gothenburg, and North Karelia, where the diagnosis of subarachnoid haemorrhage was frequently made. Patients with mild signs, i.e. speech disturbance only or monoplegia, were more common in Copenhagen than in other centres. Only a few had paraplegia or bilateral paralysis.

Diagnosis

Frequency of use of diagnostic methods. General figures were given under *Methods*. Some evidence in support of differential diagnosis, in patients who

survived sufficiently long (3 weeks or more) for diagnostic examination, is presented below.

Lumbar puncture was performed in nearly all cases reported at Ulan Bator, in 50–70% in Espoo, Gothenburg, and Zerifin, and at lower rates in other centres. Cerebral angiography was carried out in about 40% of cases in Gothenburg and in about 20% in Copenhagen, Espoo, and Japan National Railways, but much less often in other centres.

The autopsy rate for deceased stroke patients was between 60% and 80% in Copenhagen, Gothenburg, and Moscow, but was low elsewhere.

The frequency with which major types of stroke were diagnosed, and with which further confirmatory examinations—such as lumbar puncture, angiography, and autopsy—were performed is shown in Table 4 for each diagnostic category, according to centre. The diagnosis of subarachnoid haemorrhage (ICD ^a 430) had the most solid basis, since more

^a ICD = International Classification of Diseases.

Table 5. Diagnosis of stroke according to age and sex

Sex	Age	Diagnosis (ICD)												Total	
		430		431		432		433		434		436		No.	%
M	under 55	155	20.3	171	22.4	28	3.7	277	36.3	24	3.1	108	14.2	763	100
	55–64	74	7.5	152	15.3	32	3.2	424	42.7	34	3.4	276	27.8	992	100
	65–74	34	3.5	132	13.6	16	1.6	503	51.8	31	3.2	255	26.3	971	100
	75+	13	2.4	72	13.2	6	1.1	271	49.8	24	4.4	158	29.0	544	100
	All ages	276	8.4	527	16.1	82	2.5	1475	45.1	113	3.5	797	24.4	3270	100
F	under 55	134	27.8	104	21.6	10	2.1	136	28.2	18	3.7	80	16.6	482	100
	55–64	104	15.0	127	18.3	6	0.9	255	36.7	30	4.3	173	24.9	695	100
	65–74	45	4.9	140	15.1	9	1.0	461	49.8	48	5.2	222	24.0	925	100
	75+	23	2.3	155	15.2	5	0.5	463	45.4	59	5.8	314	30.8	1019	100
	All ages	306	9.8	526	16.9	30	1.0	1315	42.1	155	5.0	789	25.3	3121	100

than 90% of patients were examined for this condition. Examinations for intracerebral haemorrhage (ICD 431) were carried out at a lower, but still high, rate varying among centres. There was a high rate of examinations for cerebral ischaemic necrosis (ICD 432-434) at Dublin, Gothenburg, and Ulan Bator and a low rate in Osaka, with other centres lying in between. The number of examinations was related to the admission rate (see p. 547).

In many centres, the final diagnosis was revised according to the autopsy findings. At the North Karelia centre and all Japanese centres, clinical diagnosis was always made without knowledge of the autopsy data. Agreement between the clinical and autopsy diagnosis was studied in 79 autopsied cases at these centres. The presence of stroke was confirmed in the very high proportion of 98.6%, and the type of stroke in 80%. This speaks for the quality of neurological skill, at least as regards the diagnosis of stroke in the patients who were so severely affected that they died. However, the small number of autopsies carried out in these centres makes generalization difficult.

Clinical diagnosis by age and by sex. The diagnosis taken was that made at the first follow-up, when the immediate danger from the attack was usually over, various examinations were performed, and the course of the disease could be observed well. When a patient died within 3 weeks, the autopsy diagnosis

was used if available, otherwise the clinical cause of death was taken.

Differential diagnoses of types of stroke, by age and sex, are shown in Table 5. In general, no great differences between men and women in the frequency of the various types of stroke were observed. Subarachnoid haemorrhage (ICD 430) was diagnosed in slightly below 10% of all strokes; intracerebral haemorrhage (ICD 431), in 1 out of 6; occlusion of precerebral arteries (ICD 432), in only a small proportion; and cerebral infarction—i.e., cerebral thrombosis (ICD 433) and cerebral embolism (ICD 434)—in one-half, of which embolism accounted for about 10%. In one-quarter of cases, the type was not specified.

A difference according to age and sex was apparent as regards subarachnoid haemorrhage, which was frequent among the young, particularly those under 55 years of age, and occurred slightly more often in women than in men. Intracerebral haemorrhage was observed more often in the younger age groups. Occlusion of the precerebral arteries was diagnosed more frequently in young people, especially men. The incidence of cerebral thrombosis, cerebral embolism, and acute but unspecified stroke increased with age.

Types of stroke, according to centre. The attitude towards differential diagnosis differed in the various centres (Table 4). The type of stroke was not speci-

Table 6. Admission to hospital

Centre	Total No.	No admission		Hospitalized		Stroke occurred in hospital		Unknown or blank	
		No.	%	No.	%	No.	%	No.	%
Gothenburg	690	44	6.4	605	87.7	38	5.5	3	0.4
Copenhagen	641	79	12.3	497	77.5	65	10.1	—	
Dublin	453	55	12.1	331	73.1	67	14.8	—	
Espoo	299	36	12.0	215	71.9	48	16.1	—	
North Karelia	774	80	10.3	620	80.1	71	9.2	3	0.4
Moscow ^a									
Zagreb	475	90	18.9	380	80.0	5	1.1	—	
Zerifin	779	119	15.3	589	75.6	68	8.7	3	0.4
Epe	238	30	12.6	196	82.4	9	3.8	3	1.3
Akita	266	135	50.8	125	47.0	6	2.3	—	
Saku	546	299	54.8	230	42.1	17	3.1	—	
Fukuoka	108	52	48.1	54	50.0	1	0.9	1	0.9
Osaka	133	92	69.2	41	30.8	—	—	—	
Japan National Railways	106	35	33.0	70	66.0	—	—	1	0.9
Ulan Bator	323	141	43.7	179	55.4	—	—	3	0.9
All centres	5831	1287	22.1	4132	70.9	395	6.8	17	0.3

^a Data not available.

fied in more than one-half of registered patients in Dublin, in more than one-third in Gothenburg, Ulan Bator, and Zerifin, and in less than 10% at all the Japanese centres. The diversity in attitudes towards diagnosis and in the criteria and methods of examination used would have invalidated any comparison of the types of stroke diagnosed at the various centres. In some centres, diagnosis was presumably more reliable on account of a high autopsy rate and thorough clinical investigations.

Subarachnoid haemorrhage was frequently (in over 20%) diagnosed in patients under the age of 65 years in Dublin, Espoo, Gothenburg, and North Karelia; in 10–15% of patients in many other centres; and in fewer than 10% in Copenhagen, Zagreb, and Zerifin. Intracerebral haemorrhage was found in 10–20% of patients aged under 65 years, but was diagnosed in over one-third of patients at the Japanese centres except the Japan National Railways centre, which had a slightly lower figure.

Occlusion of the precerebral arteries requires angiography for a definitive diagnosis. It was dia-

gnosed more often in the European centres than in the others, but in no more than 5% of the former. Cerebral thrombosis was diagnosed in only 5% at Dublin, where differential diagnosis was deferred unless objective evidence had been obtained. The rate, which increased with age (the older patients were, the more frequently the condition was found), varied from 20% in Gothenburg and Ulan Bator to 60% in Copenhagen and Saku, and was in inverse proportion to the frequency of type-unspecified stroke.

Care

Admission to hospital. Of 5831 patients on whom data are available, 4132 (71%) were hospitalized and 1287 (22%) were cared for at home (Table 6); 395 (7%) had a stroke while they were in hospital for some other complaint.

The severity of the stroke, and whether or not the patient lived alone, were not important factors in the preference for hospital as opposed to home care. The traditions of the community seemed to carry greater

Table 7. Rehabilitation policy in the participating centres

Rehabilitation		Gothen- burg		Dublin	Espoo	North Karelia	Moscow	Zagreb	Zerifin	Epe	Akita	Saku	Fukuoka	Osaka	Japan National Rail- ways	Ulan Bator	Total
Up to 3 wks	3 mos to 1 yr	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
yes	yes	33	26	17	27	10	—	37	6	—	15	7	8	12	2	—	19.9
yes	yes	21	26	26	11	18	—	12	21	—	11	21	4	2	2	—	17.4
yes	no	5	4	3	5	1	—	2	3	—	—	—	—	—	—	—	2.6
yes	no	16	19	25	18	19	—	8	49	—	—	16	21	—	9	—	18.4
no	yes	1	1	—	2	2	—	3	1	—	8	5	4	2	15	—	2.7
no	yes	1	4	5	2	4	—	2	1	—	2	7	—	5	15	—	3.1
no	no	3	1	3	4	3	—	2	1	—	3	2	—	2	4	—	2.5
no	no	20	18	20	31	43	100	33	19	—	61	42	63	77	53	—	33.4
Total No. of patients		294 (100%)	142 (100%)	92 (100%)	131 (100%)	197 (100%)	2 (100%)	171 (100%)	175 (100%)	— (100%)	118 (100%)	152 (100%)	24 (100%)	43 (100%)	47 (100%)	— (100%)	1588 (100.0%)

weight in that respect. In European communities, about 70–80% of stroke patients were hospitalized, whereas only 30–50% were hospitalized in the Japanese communities except for the Japan National Railways, which had a higher rate.

A sizeable proportion of patients experienced a stroke during hospitalization for other diseases in Copenhagen, Dublin, Espoo, North Karelia, and Zerifin. The case reports of these patients revealed a history of acute myocardial infarction 3.5 times as often, and of stroke 1.3 times as often, as the case reports of other patients. Only 20% of this group had had no stroke, myocardial infarction, other heart diseases, or diabetes previously, and about 40% had had two or more of these conditions.

Rehabilitation policy. Any rehabilitation programme given by a specially trained person was accepted. No distinction was made between techniques, intervals, or durations. Rehabilitation was not given to one-third of the 1588 patients who were followed up for one year (Table 7); 70–80% of patients at Copenhagen, Dublin, Gothenburg, and Zerifin, and a smaller proportion at the Japanese centres, received early rehabilitation within 3 weeks of the onset of stroke. Information from Ibadan, Moscow, and Ulan Bator was not available. In a large proportion of the Zerifin patients, rehabilitation was discontinued after 3 weeks.

Duration of stay in hospital. Of the 2036 discharges from hospital owing to death, one-half occurred within a week, one-quarter between 1 and 3 weeks, and another quarter more than 3 weeks after the beginning of the period of observation in hospital. On the other hand, half of the 2883 patients discharged alive had been in hospital for more than a month. In Ibadan, Ulan Bator, Zagreb, and Zerifin, more than half the survivors were discharged within 3 weeks, and in Gothenburg and North Karelia, within 4 weeks; in 9 other centres, the majority stayed in hospital longer than 4 weeks.

Course of the disease and outcome

Of 6395 patients, 2137 died within 3 weeks; 4036 first-follow-up record forms (94.8% of the expected number) were received and analysed. At the time of the analysis, 18% of the 3-month follow-up reports and 54% of the one-year follow-up reports had not been received. Data on the course of the disease and on the outcome for the patients included in the study, particularly in respect of follow-up at one year, must therefore be regarded as very preliminary.

Working status. Of 3113 patients whose working status at 3 months was known, 60% aged under 65 years and one-quarter of those aged 65 years and over were gainfully employed before they had their stroke. At the 3-month follow-up, only 18% of the young and 5% of the old patients who had been employed before stroke were working as much as before. If work of any degree was counted, the proportion of patients who resumed work was 28% in the young and 14% in the old age group. Women recovered a little less well than men.

Activities of daily living. Such activities were assessed at 3 months and at one year according to the degree of independence in self-care and in walking, both components being divided into 4 classes: I, independent in both activities; II and III, partly dependent; and IV, totally dependent. At 3 weeks, independent, partly dependent, and totally dependent patients accounted for one-third each. About one-half were completely independent after 3 months (Table 8), and more than 60% were completely independent by one year. Among patients below the age of 55 years, 72% were completely independent at 3 months. Thereafter, the speed of recovery slowed down, complete independence being achieved at one year in 79%. Age strongly influenced the speed of recovery: the frequency of complete independence at 3 months decreased and total dependence increased sharply with increasing age.

Independence in self-care and walking was achieved in a smaller proportion of patients in Akita, Fukuoka, North Karelia, and Zerifin—presumably in part because of the low rates of early or continued rehabilitation at those centres.

The high mortality among greatly disabled patients might give a false impression of improved activity in the surviving population, but this seems to be only partly true. Of the patients who were totally dependent 3 weeks after stroke, one-third improved from the point of view of activities of daily living, and one-quarter died at 3 months. Half of the patients who were partly dependent at 3 weeks improved and 5% died at 3 months. Of the totally or partly dependent patients aged under 65 years, one-half improved, the corresponding proportion for dependent patients aged 65 years and over being one-third. Thus the prospects for improved activity were better for younger people and for patients who were less dependent at 3 weeks. However, older and highly disabled patients were also seen to have potential for recovery.

Table 8. Activities of daily living at 3 months after stroke, according to age

Age (years)	Patients		Activities of daily living ^a				
	No.	%	I (%)	II (%)	III (%)	IV (%)	V (%)
under 55	636	100	72.4	11.6	8.6	5.0	2.2
55-64	945	100	59.3	15.7	13.3	10.4	1.4
65-74	981	100	43.4	19.9	19.3	16.2	1.2
75+	551	100	27.2	18.9	24.3	29.0	0.5
All ages	3113	100	51.3	16.7	16.2	14.4	1.3

^a Class I, completely independent; Class II, partly dependent (grade 1); Class III, partly dependent (grade 2); Class IV, totally dependent; and Class V, unknown.

The number of bed-ridden and chair-ridden patients decreased rapidly during the period immediately following stroke, and thereafter decreased more slowly. At 3 weeks, 40% were bed-ridden; at 3 months, the proportion had fallen to 15%, and at one year it was 10%. The fact that death occurs more frequently in bed-ridden patients must be taken into account in interpreting the data regarding the course of the disease. Control of the bladder was impaired in one-quarter of patients at 3 weeks and in 10% at one year.

The potential for recovery with regard to the above-mentioned aspects was generally higher within 3 months of stroke than it was later.

Complications after stroke. Bedsores and joint contractures could be prevented in nearly all patients if adequate care were continued. Their frequency, therefore, may reflect the adequacy or inadequacy of care. Data on 1134 patients who were in hospital in October 1973 are presented here.

The number and size of any bedsores were recorded. About 5% of patients had bedsores at the first follow-up. Of these 5%, 2% died. Bedsores disappeared in half of the remainder and persisted in the other half. They reappeared in 1.5%, so that, at 3 months, 3% of all patients had bedsores.

A similar trend was observed as regards contractures of the joints. No distinction was made between joints or degrees of restricted movement. The prevalence of joint contractures was a little higher than that of bedsores and the condition was characterized by a lower recovery rate. It was observed in 8% of patients at 3 weeks. In 2% of these 8%, the contrac-

tures disappeared and in 4% they remained; 2% of the patients died within 3 months. New contractures appeared in 4%, maintaining the prevalence rate at 8%.

Neurological status. Hemiplegia, which appeared in 70% of patients within 24 h of the onset of stroke, was still present in half of those surviving at 3 months. There was a sharp decline in the numbers of those in the "signs not assessed" category, since most of these patients died early and signs could be assessed in the survivors. The proportion of patients without speech disturbance or paralysis of the limbs gradually increased, from 5% on the first day to 30% at 3 months.

Case-fatality rate

Case-fatality rate. Death occurred on the day of the stroke in 12%, at one week in one-quarter, and at 3 weeks in one-third; 60% of patients were still alive at 3 months, and a little more than half at one year. The age of a patient was a strong determinant factor in survival. The difference between men and women was not significant. The case-fatality rate in two age groups is illustrated in Fig. 1. Initially, the number of survivors declined rapidly. This decline continued in patients aged 65 years and over, but slowed down in those below the age of 65.

The case-fatality rate varied considerably according to the type of stroke diagnosed. Intracerebral haemorrhage the most often had a fatal outcome; more than one-third of patients died on the day of the attack, irrespective of age, and 70–80% died within a year. The next most frequently fatal type of stroke was subarachnoid haemorrhage: 45% of the young and 60% of the old died within one year. Cerebral

ischaemic necrosis showed the lowest fatality rate, beginning with only 4% and 5% on the first day, and reaching 20% and 45% at one year, in young and old patients, respectively. The case-fatality rate among patients with type-unspecified stroke fell between that for subarachnoid haemorrhage and that for cerebral ischaemic necrosis—reflecting the mixed nature of the haemorrhagic and ischaemic types of stroke.

The case-fatality rate differed among centres. Early death was frequent in young patients at the Fukuoka, Japan National Railways, and Ulan Bator centres, and in old patients at Osaka, Ulan Bator, and Zerifin. The rate was low in Copenhagen and Ibadan. No attempt at interpretation can be made in this preliminary analysis.

Factors related to the case-fatality rate. Factors other than the age and sex of patients and the type of stroke diagnosed are commented upon here.

As regards the clinical manifestations of stroke, by far the most important prognostic factor was the level of consciousness. If this was lower by one grade of the four-grade classification, the fatality rate was doubled or even more than trebled in both young and old patients. The gradient was particularly remarkable on the first day, when 40% of comatose, 12.5% of semicomatose, 5% of somnolent, and 0.5% of fully conscious patients died. Patients whose consciousness was not assessed had the worst outcome: 70% of these died on the first day. Probably these patients were the most severely affected, having died before being seen by a physician. Higher case-fatality rates in young comatose patients than in old ones were observed during the first few days—probably because subarachnoid or intracerebral haemorrhage, which is more often fatal and often accompanied by coma, occurs more frequently in young persons.

Dependency before stroke was a major determinant factor in case reports, followed by a history of a stroke. Previous hypertension, acute myocardial infarction, and diabetes played a minor role in relation to the case-fatality rate.

Very high blood pressure (systolic: 200 mmHg and over; diastolic: 115 mmHg and over) in both young and old patients, and low blood pressure (systolic: below 165) in old patients was related to a higher case-fatality rate at the early stage of stroke. A blood pressure of less than 165 mmHg in old patients immediately after stroke may imply not a "normal" blood pressure, but hypotension. Very high blood pressure as defined above, when recorded 3 weeks

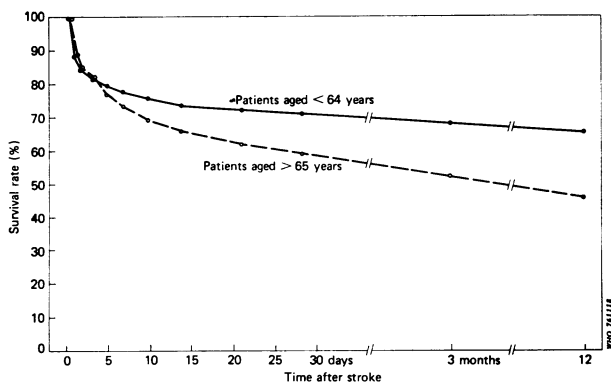


Fig. 1. Survival after stroke.

after the onset of stroke, led to a higher case-fatality rate in young patients only.

Another expression of the severity of stroke is the class of activities of daily living: the proportions of patients who were in classes I, II, III, and IV at 3 weeks and who died between 3 weeks and 3 months after stroke were 2%, 4%, 6%, and 26%, respectively.

Complications may arise as a result of inadequate care of severely affected patients, and are a bad sign for prognosis. Thus, 40% of patients with bedsores and 30% of those with contractures of the joints at 3 weeks died within 3 months of stroke.

DISCUSSION

This is a preliminary report presenting some notable characteristics of acute cerebrovascular diseases in communities with different populations and systems of medical care. The definitive results of the study, with a more detailed analysis, will be reported later. The aim of this pilot study was to develop methods and to determine the feasibility and uses of a stroke register as a means of controlling stroke in the community. Since such a register had been operated by all the participating centres for 2–5 years, its feasibility was demonstrated.

Local collection of basic information was useful for stroke control in the community concerned. It also appeared desirable to assemble comparable data for epidemiological purposes. A prerequisite for the comparison of incidence in various places is an identical method of diagnosing a disease in all the places. Trials for standardizing the diagnosis of stroke were carried out and the results are reported in another paper. The data presented here are the best available, since the definitions, criteria, and method of reporting were agreed upon, comparability tests were repeated, and each participating centre made great efforts to achieve complete coverage of all stroke patients in the study community.

Geographical variations in incidence rates were observed. High-incidence areas, such as Akita, North Karelia, and Saku, seem to have certain characteristics in common: a cold winter, a high proportion of economically underprivileged people, and a population living mainly off agriculture or forestry, which require strenuous physical labour. The high proportion of patients who were dependent or partly dependent in self-care and in walking in Akita, North Karelia, and Zerifin may be related to

a lower rate of early or continued rehabilitation. Except for Zerifin, all these areas also showed a high incidence rate. Accelerated aging in poorer people may be another explanation and requires further research.

Unlike ischaemic heart disease, stroke occurred in developing as well as developed countries, and there was less divergence between the incidence rates for men and for women.

The accuracy of differential diagnosis varied, and results from various centres cannot be compared without caution. The frequency of acute but unspecified types of stroke demonstrated the differences in the methods of diagnosis used in the participating centres. Subarachnoid haemorrhage may have been an exception in this respect. The high case fatality rate in some areas may have been due partly to the type and severity of common stroke. Subarachnoid haemorrhage at the early stage and intracerebral haemorrhage until the late stage were highly fatal. This may, however, be interpreted the other way round: the type diagnosis may be a reflexion of case-fatality influenced by the quality of care or the general health of a patient. Such an interpretation is plausible, since case-fatality was high in some communities where the admission rate was low, detailed examination was performed less often, and rehabilitation services were insufficient.

Etiology, treatment, and prognosis differ according to the type of stroke, and therefore accurate diagnosis is essential. Epidemiological methods for differential diagnosis need to be developed in order to advance research in this field.

Few attempts were made to identify risk factors. The reliability of memory-dependent case histories is limited. However, hypertension, heart disease, and previous stroke appear to be common among stroke patients. In some areas, the rate of associated diabetes was high and may be important. In order to quantify the risk of these conditions in various communities, their frequency should be compared, by means of a standard method, with that in the general population—preferably in a prospective study.

Transient cerebral ischaemic attack was not studied because of the difficulty of deciding on uniform and valid criteria. Since this condition has been known as a factor predisposing to cerebral infarction, the formulation of standard questionnaires should be promoted.

One of the purposes of the multicentre stroke register is to reveal any inadequacy or inefficiency in

medical services. Hospital admission rates differed among communities, owing to variations in the availability of hospital services and also to traditional attitudes of physicians and patients' families towards hospitalization.

Adequate therapy must be based on a complete examination of the patient. Thorough examinations and intensive treatment are generally carried out in hospitals that are well staffed and well equipped.

Apathy in the care of stroke patients must be overcome: we have seen significant recovery potential in both the old and the severely disabled.

It is apparent from the preliminary results of this study that stroke is a highly fatal, disabling, and costly disease. Primary prevention is the best way of tackling the problem of stroke in the community.

There was a generally low rate of treatment of hypertension among stroke patients, with considerable differences between centres. A low rate suggests that the control of hypertension at the community level needs to be intensified. A high rate may be real, but might mean incomplete case-finding—e.g., the selected registration of patients from high-powered medical services. In any case, the data indicate the current status of stroke control in certain areas, and the value of a stroke register for public health and for research.

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K. Aho, Central Hospital, Kotka, Finland.

O. O. Akinkugbe, Faculty of Medicine, University of Ibadan, Nigeria.

N. Dondog, Department of Cardiovascular Diseases, Medical Research Institute, Ulan Bator, Mongolia.

Y. Fukuda, Central Health Institute, Japan National Railways, Tokyo, Japan.

M. L. Gander, International Classification of Diseases, World Health Organization, Geneva, Switzerland.

L. Geltner, Asaf Harofe Government Hospital, Tel Aviv University Medical School, Zerifin, Israel.

P. Harmsen, Department of Neurology, Sahlgren's Hospital, Gothenburg, Sweden.

S. Hatano, Department of Epidemiology, Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan.

K. Isomura, Saku Central Hospital, Nagano, Japan.

S. Kojima, Central Institute of Health, Akita, Japan.

Y. Komachi, Centre for Adult Diseases, Osaka, Japan.

T. Kondo, Central Health Institute, Japan National Railways, Tokyo, Japan.

A. Makinskij, Institute of Neurology, Academy of Medical Sciences of the USSR, Moscow, USSR.

J. Marquardsen, Department of Neurology, Frederiksberg Hospital, Copenhagen, Denmark.

T. Omae, Faculty of Medicine, Kyushu University, Fukuoka, Japan.

B. O. Osuntokun, Faculty of Medicine, University of Ibadan, Nigeria.

Z. Poljaković, Centre for Cerebrovascular Diseases, Zagreb, Yugoslavia.

P. Puska, North Karelia Project, University of Kuopio, Finland.

A. Radić, Medico-Social Research Board, Dublin, Ireland.

K. Salmi, North Karelia Central Hospital, Joensuu, Finland.

E. V. Smidt, Institute of Neurology, Academy of Medical Sciences of the USSR, Moscow, USSR.

V. E. Smirnov, Institute of Neurology, Academy of Medical Sciences of the USSR, Moscow, USSR.

K. Uemura, Division of Health Statistics, World Health Organization, Geneva, Switzerland.

RÉSUMÉ

EXPÉRIENCE TIRÉE D'UN REGISTRE MULTICENTRIQUE D'ACCIDENTS VASCULAIRES CÉRÉBRAUX: RAPPORT PRÉLIMINAIRE

Ce travail présente les résultats préliminaires du Registre OMS des accidents vasculaires cérébraux, qui couvre 6395 malades dans 15 centres participants de dix pays entre 1971 et 1974.

Des critères et des formules d'observation uniformes ont été utilisés. On s'est efforcé d'enregistrer tous les cas apparus dans la population étudiée.

L'incidence augmente nettement avec l'âge. Contrairement aux cardiopathies ischémiques, les accidents vasculaires cérébraux se produisent aussi bien dans les milieux modestes que dans les milieux riches, avec un écart

moindre entre hommes et femmes. Le taux de morbidité se montre particulièrement élevé chez les Finlandais et les Japonais.

Le diagnostic de la variété d'accident n'est pas comparable dans les divers centres par suite de leur différence d'attitude diagnostique et du caractère plus ou moins approfondi des examens réalisés. Souvent, les observations font mention de maladies chroniques. L'hypertension artérielle est la plus fréquemment signalée — par plus de la moitié des sujets étudiés. Pourtant, un tiers de ces cas n'étaient pas traités.

Le taux d'hospitalisation varie de 30% à 80%, selon le centre. Dans les collectivités où le taux d'admission est faible, les examens restent superficiels.

Pour 15-80% des cas, la réadaptation commence dans les trois semaines qui suivent l'accident. En ce qui concerne les sujets occupant avant leur maladie un emploi rémunéré, un quart environ de ceux qui ont moins de 65 ans et un septième de ceux qui atteignent ou dépassent cet âge reprennent plus ou moins leur travail au bout de trois mois.

La moitié des individus encore en vie au bout d'un trimestre présentent une hémiplégie, mais les trois quarts d'entre eux se suffisent à eux-mêmes pour les besoins courants et la marche. Les vieillards, et ceux qui étaient totalement dépendants d'une tierce personne, au bout

de trois semaines, améliorent d'eux-mêmes leurs activités quotidiennes, quoique à un degré moindre.

Environ un tiers des malades sont décédés dans les trois semaines. Un peu moins de la moitié étaient en vie un an après l'accident. Les facteurs de mauvais pronostic sont: le grand âge; la sévérité de l'attaque se traduisant par le degré de perturbation de la conscience ou par l'impossibilité de déterminer l'état neurologique dans les 24 heures suivant l'accident; les accidents hémorragiques; l'hypertension à tous âges, ou l'hypotension existant chez les sujets âgés au premier examen; l'état de dépendance vis-à-vis d'autrui antérieurement à l'accident; et les complications telles que escarres et raideurs articulaires observées au bout de trois semaines.

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